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SPRING HOLDER

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2,822,677

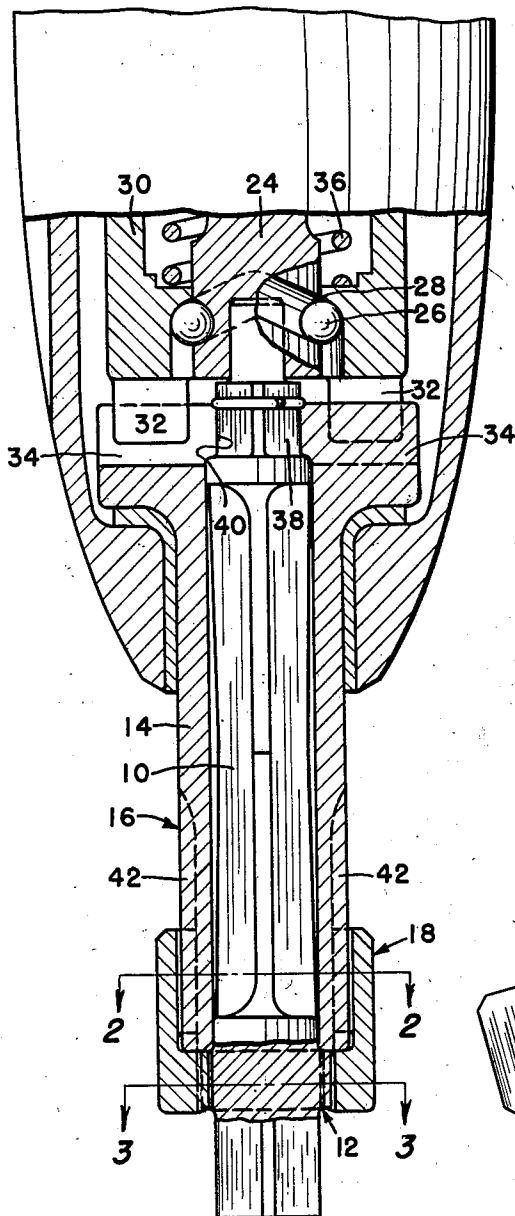


FIG. 1

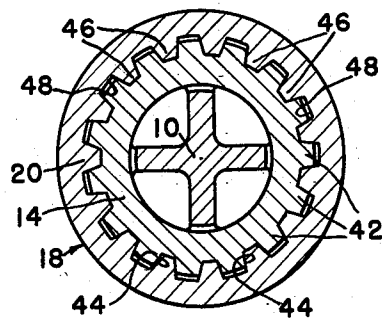


FIG. 2

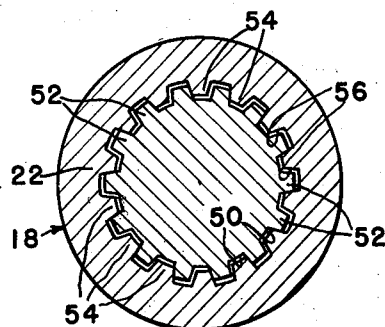


FIG. 3

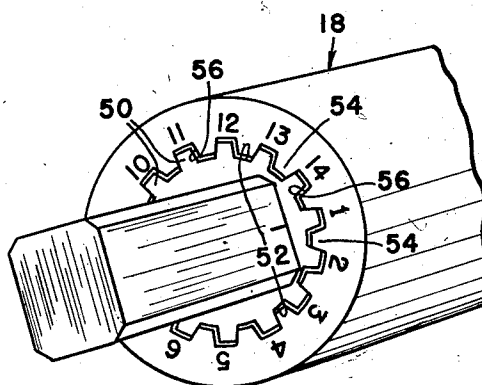


FIG. 4

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SPRING HOLDER

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6 Claims. (Cl. 64—15)

This invention relates to spring holders, and more particularly to an adjustable device adapted to hold a torsion spring in any one of a number of positions of pretension.

It is one object of this invention to provide a spring holder which is relatively simple in construction and easily adjustable to obtain various degrees of tension of the spring held thereby.

A second object of the invention is to provide such a holder in which the degree of stress of the spring may be easily determined.

Another object of this invention is to provide such a spring holder in which relatively fine adjustment of the degree of tension of the spring is obtainable.

Other objects of the invention will become obvious from the following specification and attached drawing in which—

Figure 1 is a longitudinal sectional elevation showing an impact tool, in part, to which the spring holder is adapted,

Figs. 2 and 3 are cross sectional views of Fig. 1 taken along the lines 2—2 and 3—3, respectively, looking in the direction of the arrows, and

Fig. 4 is a perspective view looking at one end of the spring holder.

Referring to the drawings, and particularly to Fig. 1, a preferred embodiment of the spring holder is shown adapted to a torsion type spring 10 having a splined portion 12 at its outer end. The spring holder comprises, in general, a member 14 engaged to the inner end of the spring against rotation relative thereto and having a splined portion 16 at its opposite end. The spring is placed under stress by rotating the splined end portion of the spring and at the same time holding the member 14 against rotation. When the desired degree of stress is obtained, a coupling element 18 is positioned on the spring 10 and member 14 with splined portions 20 and 22 engaging the corresponding splined portions 12 and 16 on the spring 10 and member 14, respectively.

It is to be noted that this splined connection is such that limited movement of the spring 10 relative to the member 14 is permitted. In order to fully understand the purpose of this detail of the invention, the spring holder and spring are shown adapted to a conventional rotary type impact tool commonly used for rotating screws, nuts and the like. The particular impact tool shown, in part, is fully described in U. S. Patent No. 2,160,150. This tool comprises, in general, a continuously rotated motor driven spindle 24 connected through a ball-cam 26—28 to rotate a hammer 30. The hammer 30 is provided with a pair of depending jaws 32 arranged to engage a pair of similarly constructed jaws 34 mounted on the member 14, which in the embodiment of the invention disclosed serves additionally as the anvil of the impact tool.

The operation of the tool is such that the hammer is held in engagement with the anvil by a spring 36 whenever the resistance to rotation of the anvil is below a predetermined value—for example, the run down portion of

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a nut tightening cycle. When this value is exceeded, the hammer is cammed rearwardly by the ball-cam 26—28 out of engagement with the anvil 14 and then quickly accelerated both rotationally and forwardly to strike a hammer blow on the anvil.

In the normal construction of an impact tool such as disclosed in the cited patent, the force of this blow is transmitted by the anvil directly to the work. In the construction shown, however, a spring is interposed between the anvil and the work. It is to be noted that because one end of the spring is engaged to the work, whenever a turning force is applied to the opposite end by the anvil there is a tendency for the spring to be wound up and hence move the work end of the spring relative to the anvil.

In order to avoid this action when the work is below a predetermined degree of tightness, the spring is placed under tension, or stress, in a direction opposing relative rotation between the spring 10 and the anvil member 14. Accordingly, until the rotational force of the hammer exceeds the pretensioned force of the spring, the spring acts as a substantially rigid element. When this force exceeds the pretension of the spring, then the spring is further tensioned by the action of the anvil. The energy of this excess force is accumulated by the spring and thereafter returned to the hammer in accentuating the rebounding thereof. In this way the amount of torque transmitted to the work is limited to the degree of pretensioning of the spring.

In order, however, that the spring may be further tensioned by the anvil to accomplish the result specified, it is necessary that the splined end of the spring be free to move relative to the member 14, and it is for this reason that the spring holding device is designed to permit such limited relative rotation.

Referring now to the structural details of the spring holding device shown, the spring disclosed is cruciform in cross sectional form and is provided at one end with a square 38 fitted in a square socket 40 in the member 14. The member 14 is substantially tubular in shape encircling the spring 10 and extending therealong to the splined portion 12 of the spring.

The coupling element 18 is in the form of a tubular element having splines and grooves 46 and 48 corresponding in size and number to the splines and grooves 42 and 44 of the member 14 such that there is a relatively tight fit therebetween whenever the coupling element is in its assembled position as shown in Fig. 1.

The opposite end portion of the bore of the coupling element 18 is somewhat reduced in diameter and is formed with splines and grooves 54 and 56 equal in number to the splines and grooves 50 and 52 of the spring 10 and adapted to receive this portion of the spring. It is to be noted, however, that the grooves 56 in the coupling element 18 are substantially greater in width than the width of the splines 50 of the spring (see Figs. 3 and 4), and the grooves 52 of the spring are of substantially greater width than the width of the splines 54 of the coupling element so as to permit limited relative rotational movement between the spring and the member 14 for the reasons specified hereinbefore.

It will be noted further that the number of splines 42 of the member 14 are equal to the number of splines 46 of the splined portion of the coupling element 18 received thereby but are not equal to the number of splines 50 of the splined portion of the spring 10 or the associated splines 54 of the coupling element 18.

The reason for providing this unequal number of splines on the spring and the member 14 is to obtain a greater number of engaging positions of the element 18 with the spring and the member 14 for 360° of revolution of the spring, the coupling element 18 and member 14 being held stationary, than is possible if an equal num-

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ber of splines were used. In other words, if the number of splines on the spring 10 and the member 14 were equal, then it is clear that in order to rotate the spring 10 from one position to the next at which the coupling element can be mounted, the spring would have to be rotated through a number of degrees determined by the equation—360 divided by the number of splines. In the present invention this number of degrees of movement of the spring between engaging positions of the coupling element is reduced to obtain a finer degree of adjustment of the spring by providing a greater number of splines on the member 14 than on the spring. The number of degrees between engaging positions of the coupling element 18 is determined by the equation

$$\left[\frac{1}{\text{Number spring splines } 50} \text{ less } \frac{1}{\text{number member splines } 42} \times 360 \right]$$

Another advantage of this construction is that a fewer number of splines may be placed on the relatively small diametered spring and thus the size of the splines may be maintained sufficiently large to withstand any stress or hammer action to which they are subjected during the operation of the tool or other apparatus with which the spring is associated.

Utilizing the above equation and knowing the spring constant of the spring 10, the amount of stress applied to the spring in moving from one engaging position to the next may be readily calculated. For example, if the spring is rotated 10° between each engaging position of the coupling element and the spring has a constant of six foot pounds per degree, then it is clear that the spring is stressed sixty foot-pounds between each engaging position of the coupling element 18.

In order that the operator assembling the spring in a pretensioned state may readily determine the number of engaging positions through which the spring is rotated and hence determine the approximate degree of tension of the spring, an index mark 58 is placed on the spring to indicate the position of one of the spring splines 50 and index marks, as for example 1-14, are provided to indicate each of the grooves 56 of the coupling element 18.

I claim:

1. A device for holding under stress a spring having a

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grooved and splined end portion, comprising a member engaged to the other one end portion of the spring against relative rotary movement and having a grooved and splined end portion adjacent said splined end of the spring, and a coupling element having a splined and grooved portion adapted to receive the splines on said member and a second splined and grooved portion adapted to receive the splines on said spring, the grooves in the first said splined portion of said element are of substantially greater width than the splines of the spring so as to permit limited relative rotation between the splined end portion of the spring and the associated end of said member.

2. The device claimed in claim 1 in which the number of splines on the spring is different than the number of splines on said member.

3. The device claimed in claim 2 in which an index mark is provided on the spring and marking is provided on said member to show the angular relation therebetween.

4. The combination of an elongated torsional spring having an external splined portion at one end section thereof, a tubular member encircling said spring and positively engaged to the opposite end section of said spring against relative rotation in either direction, said member terminating at one end adjacent said splined portion of the spring and having external splines on the periphery of said end, and a tubular coupling element adapted to be positioned to encircle the splined portions of the spring and of the tubular member and having internal splined portions constructed to mate with the splined portions of the spring and of said member.

5. The device claimed in claim 4 in which there is a greater number of splines on said member than on the spring.

6. The device claimed in claim 5 in which there is a loose fit between the connecting splined portions of the coupling element and said spring.

References Cited in the file of this patent

UNITED STATES PATENTS

1,884,029	Luyks	Oct. 25, 1932
2,250,736	Torresen	July 29, 1941
2,527,517	Barker et al.	Oct. 31, 1950